FLUKE®

# Instruction Sheet

# 80i-1010
## DC/AC Current Probe

**Batteries:**
QUANTITY/TYPE: two 1.5V AAA
LIFE: 200 hours continuous use typical
LOW INDICATION: Output voltage is between 0.0 and -99.9 mV with power switch off (load impedance >1 MΩ).

**Safety:** Protection Class II as defined in IEC 348 and ANSI C39.5

### VOLTMETER COMPATIBILITY

The 80i-1010 is compatible with any voltmeter, multimeter, or other voltage-measuring instrument that has the following features:

- Input jacks that accept Fluke safety-designed shrouded banana plugs.
- Range and resolution capable of displaying 1 mV of output per amp of measured current.
- Voltmeter accuracy (uncertainty) of 0.3% or better to take full advantage of the accuracy of the probe.
- Input impedance of 1 MΩ, 100 pF or greater. (See the Load Impedance specifications for operation with lower impedance instruments.)

When the probe is making a measurement, the current-carrying conductor is not broken and remains electrically isolated from the probe's output. As a result, the probe's output common may be either floated (isolated) or grounded.

### BATTERY INSTALLATION

The 80i-1010 requires two 1.5V, AAA size batteries for operation. Install the batteries as follows:

1. Use your thumbnail to raise the latch and open the battery compartment (see Figure 1).
2. Observe the polarity markings on the inside of the battery door. Note that the polarity for each battery is the reverse of the other.
3. Install the batteries so that the polarity markings on the batteries match the markings on the battery door.
4. Snap the battery door shut.

*NOTE*

*If both batteries are not installed with the correct polarity, the battery test may indicate that the batteries are good, but the probe will not operate.*

### BATTERY TEST

Use the following procedure to test the batteries:

1. Connect the probe output leads to the voltmeter inputs: black to COMMON or LOW, and red to VOLTS. (See Figure 1.)
2. Set the voltmeter function to dc millivolts (dc mV⎓), and turn the voltmeter power on. Select a range capable of displaying 170 mV dc.
3. Verify that the power switch on the probe is in the OFF position.

4. Observe the voltmeter reading. If the reading falls between -100.0 and -170.0 mV, the probe is ready for use. (New batteries should read approximately -150 mV.)
5. If the reading falls between 0.0 and -99.9 mV, both batteries should be replaced. If the voltmeter reading is positive, either the test leads are reversed or the batteries are installed incorrectly.

*NOTE*

*The probe's internal circuit operation causes the two batteries to discharge at different rates. Therefore, it is essential that both batteries be replaced simultaneously when the battery test voltage falls below the lower operating limit.*

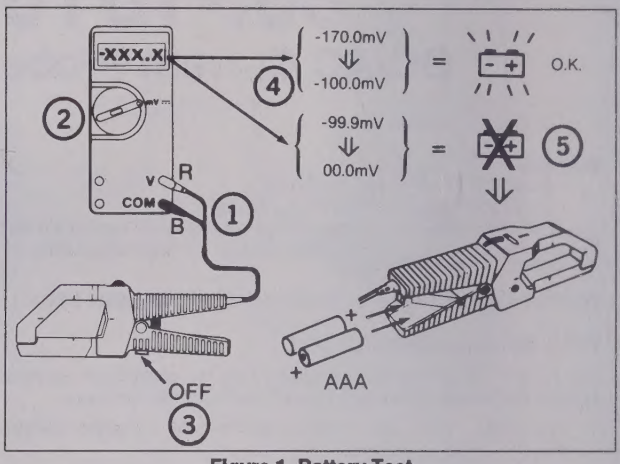



**Figure 1. Battery Test**

## OPERATION

### DC ZERO Adjustment

*NOTE*

*The DC ZERO Adjustment procedure is required when measuring dc or ac + dc currents in conjunction with a voltmeter function that is dc coupled. The DC ZERO Adjustment procedure is not required when measuring ac current only with a voltmeter function that is ac coupled.*

1. Connect the probe output leads to the voltmeter inputs: black to COMMON or LOW, and red to VOLTS.
2. Set the voltmeter function to dc millivolts (dc mV⎓), and turn the voltmeter power on. Select a range capable of displaying 10 mV dc or more.
3. Turn the probe ON/OFF switch located on the probe handle to the ON position.
4. Observe the voltmeter display and adjust the thumbwheel ZERO control for a reading as close as possible to 0.0 mV (see Figure 2).

*NOTE*

*When making low level measurements below 5A, improved accuracy can be achieved by performing the DC ZERO Adjustment procedure before each measurement. It is also advisable to check the ZERO adjustment if the current being measured has undergone a large change i.e., from 100A to 1A or if the measured current has changed polarity.*

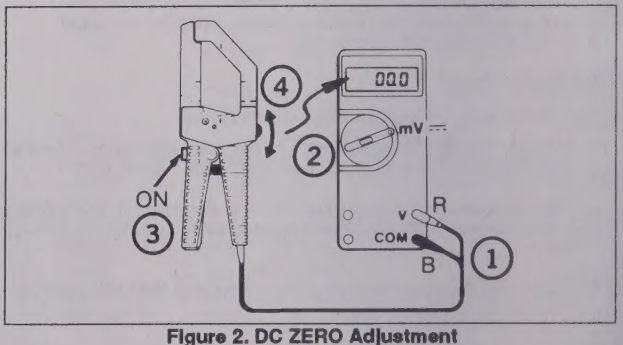



**Figure 2. DC ZERO Adjustment**

## Making Measurements

Use the following procedure to make current measurements (see Figure 3):

1. Connect the probe output leads to the voltmeter inputs (black to COMMON or LOW and red to VOLTS).

*NOTE*

*Refer to Table 1 to determine the appropriate input jack and proper function setting for use with a Fluke handheld DMM.*

2. If necessary, perform steps 2 through 4 of the DC ZERO Adjustment procedure.
3. Verify that the power switch on the probe is in the ON position.
4. Turn on the voltmeter and select a voltage range to display the expected value (1 mV per amp).

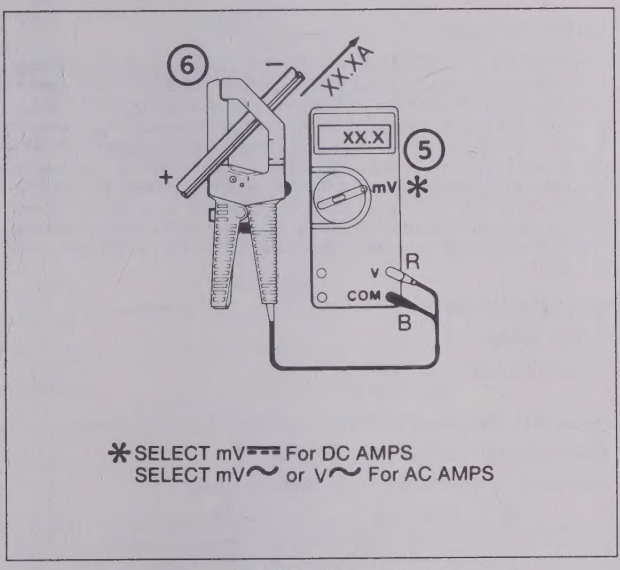



**Figure 3. Making Measurements**

**Table 1. Clamp/Meter Setup Guide**

| FLUKE MODEL | INPUT JACK (for red lead) | FUNCTION |
|---|---|---|
| 21, 23, 21 Series II, 23 Series II | V Ω →\|← | 300mV dc or Vac* |
| 25,27 | V Ω →\|← | mV dc or ac |
| 70 Series II | V Ω →\|← | 300mV dc or Vac* |
| 73, 73 Series II | V Ω →\|← | 300mV dc or Vac* |
| 75,77, 75 Series II, 77 Series II | V Ω →\|← | 300mV dc or Vac* |
| 29,79 Series II | V Ω →\|← | mV dc or Vac |
| 83,85,87 | V Ω →\|← | mV dc or Vac |
| 8060A,8062A | V Ω or V Ω S | V dc or ac** |
| 8020A,8020B, 8021B,8022A, 8024A,8024B, 8026B | V Ω or V Ω S | V dc or ac** |

*Limited to 1A resolution for ac current
**200mV range for up to 200A, 2V range for up to 1000A

*NOTE*

*When measuring ac current, and using a meter without an ac mV function, use the ac Volt function. With many meters, this will limit resolution to 1A and readings will appear divided by 1000. For example, a 15A reading will appear as 0.015V.*

5. Select the appropriate ac or dc function on the voltmeter.

6. Clamp the jaws of the probe around the conductor to be measured. Position the probe so that the conductor is in the center of the jaw opening for the most accurate reading.

*NOTE*

*When measuring current in an ac line cord, the jaws should be clamped around only one conductor (the black or hot wire in a three-wire cord). If the jaws are clamped around both current carrying conductors, the currents will cancel and produce a zero reading.*

7. Observe the voltmeter display. The reading in millivolts is equivalent to the current in amps (i.e., 5 mV = 5A). A positive polarity reading indicates that the dc current is flowing in the direction of the arrow on the probe (see Figure 3.)

### Low Level Measurements

The 80i-1010 is specified to measure currents of 1A or greater. Currents below 1A can be accurately measured by looping the input wire through the jaws of the probe so that the sum of the amp-turns through the jaws is greater than 1A. The actual current can then be calculated by dividing the meter reading by the number of turns looped through the jaws. (Refer to the NOTE at the end of the DC ZERO Adjustment procedure.)

## TROUBLESHOOTING

If the 80i-1010 does not perform properly, use the following steps to help isolate the problem:

1. Inspect the jaw mating surface for cleanliness. If any foreign material is present, the jaws will not close properly and errors will result.

2. Inspect the batteries to make sure they are installed with the proper polarity. (Refer to the BATTERY INSTALLATION procedure.)

3. Test the batteries. (Refer to the BATTERY TEST procedure.)

4. Verify that the probe leads are connected to the VOLT input of the meter.

5. Verify that the function selection on the meter is correct, i.e., dc mV for dc current or ac mV for ac current.

## CALIBRATION

### Required Equipment

The equipment required to calibrate the 80i-1010 is listed in Table 2. If you do not have all the required equipment, send the 80i-1010 to a Fluke Technical Center for calibration.

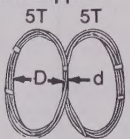
### Adjustments and Procedures

*NOTE*

*The following procedures are interactive and must be performed in the order given.*

1. Set up the 80i-1010 for calibration as follows:
   a. Connect the 10-turn butterfly coil to the output of the Transconductance Amplifier.
   b. Connect the DC/AC Voltage Calibrator output to the amplifier input.
   c. Turn both instruments on and allow sufficient warm-up time for stable operation.
   d. Open the jaws of the probe and inspect the mating surfaces for foreign material. If necessary, clean the plates with a dry cloth.
   e. Perform steps 1 through 4 of the BATTERY TEST procedure.

**Table 2. Required Equipment**

| INSTRUMENT TYPE | RECOMMENDED MODEL |
|---|---|
| DC/AC Voltage Calibrator | Fluke Model 5100B |
| Transconductance Amplifier | Fluke Model 5220A* |
| Digital Multimeter (with AC coupling on ac voltage ranges) | Fluke Model 8050A |
| Magnet Wire Coil: 50 turns of #10 single conductor copper wire 3.5 in. diameter wound in 270° torroid configuration | Customer Supplied   D ≥ 10 in. (250 mm) d ≤ ⅝ in. (15 mm) |
| Magnet Wire Coil: 10 turns (2 x 5) of #14 single conductor shaped in a butterfly configuration of two 10 in. diameter coils (10 turn 15" dia. is an acceptable alternative) | |
| Small insulated screwdriver | Spectrol |

* For high current testing at 400 Hz, substitute with Ballantine Model 1620 and reduce the number of turns on the magnet wire coil.

f. Observe the voltmeter reading. If the reading falls between -110.0 and -170.0 mV, the probe is ready for calibration.

g. Verify that the probe is approximately at room temperature.

2. Use the following procedure to demagnetize the probe. This procedure should be performed prior to each final adjustment:

   a. Set the calibrator and amplifier controls to source 10A at 50 or 60 Hz ac in the 10-turn coil, thus producing 100A turns.

   b. Clamp the probe around the center of the coil, wait a few seconds, then slowly remove it from the coil.

   c. Snap the jaws of the probe to insure that the mating surfaces are properly seated as follows:

      1. Use the thumb and forefinger of one hand to grasp the probe in the middle where the two screw heads are exposed.
      2. With your other hand, compress the handles together, then release them suddenly. The jaws should come together with a snapping action.
      3. Repeat steps 1 and 2 above, twice.

3. Use the following procedure to make the preliminary COARSE ZERO adjustment:

   a. Slide the 80i-1010 power switch to the ON position.

   b. With the voltmeter in the dc function (and the thumbwheel R101 approximately centered), adjust R2 (COARSE ZERO) for a reading of 0.0 ± 10 mV (see Figure 4). This completes the preliminary COARSE ZERO adjustment procedure.

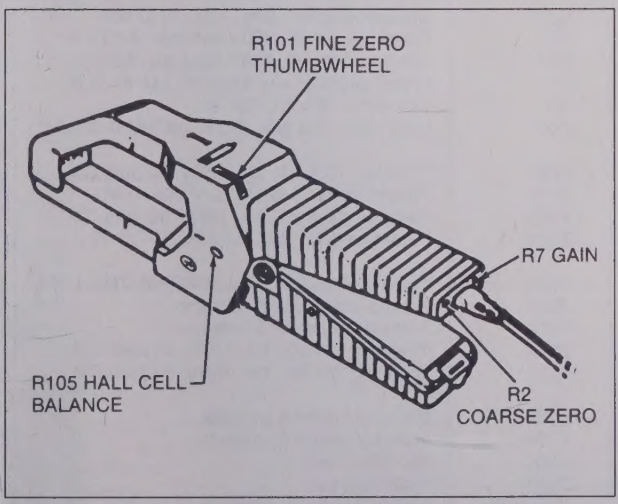



**Figure 4. Location of Adjustments**

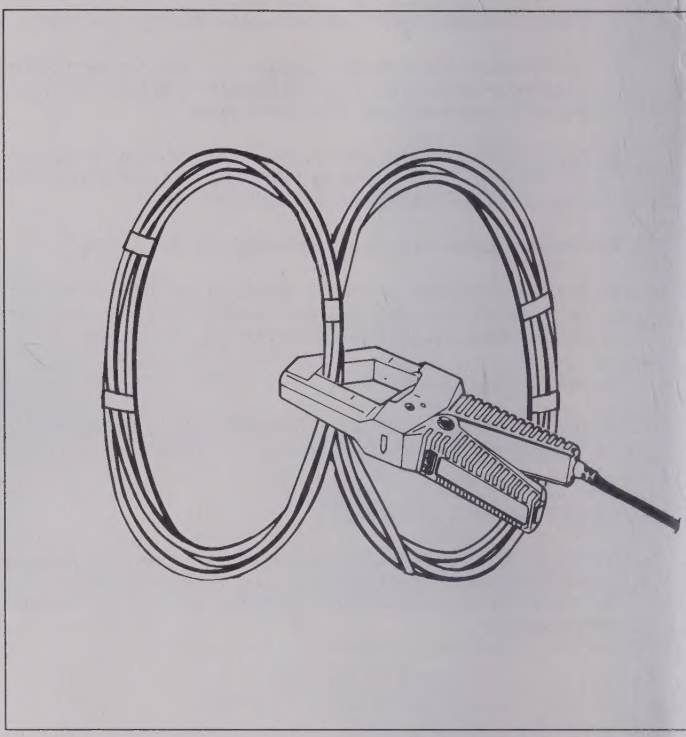
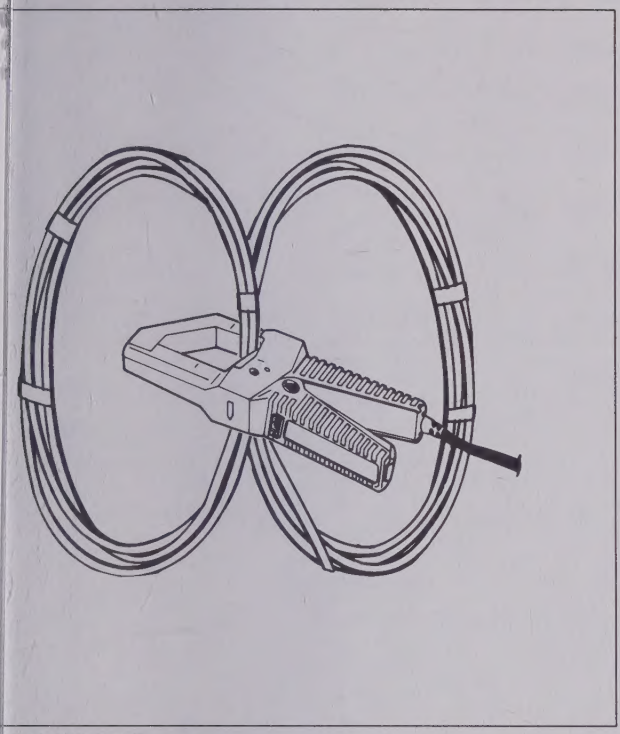


**Figure 5. Conductor Positions**

4. Use the following procedure to make the preliminary GAIN adjustment:
   a. Set the voltmeter function and range to accommodate a display of 100 mV ac.
   b. Verify that the voltmeter is ac coupled by changing the thumbwheel ZERO control and observing that the reading returns to the previous value after a brief settling period.
   c. Clamp and center the probe around the 10-turn coil and adjust R7 (GAIN) to obtain a voltmeter reading of 100 mV ±5 mV. This completes the preliminary GAIN adjustment procedure.
5. Use the following procedure to make the BALANCE adjustment:
   a. Move the probe to position the butterfly conductor alternately back and forth between the two opposite corners of the jaw opening as shown in Figure 5. Observe the voltmeter reading and adjust R105 (BALANCE) to equalize the readings (within ±0.5 mV) at the two different positions.
   b. Slowly open the jaws and remove the probe from the coil.
   c. Set the amplifier to standby.
   d. Snap the probe jaws twice as described in step c, substeps 1, 2, and 3 of the demagnetization procedure. This completes the BALANCE adjustment procedure.
6. Use the following procedure to make the final COARSE ZERO adjustment:
   a. Set the voltmeter function and range to accommodate a display of 10 mV dc.
   b. Turn the thumbwheel ZERO control (R101) to one extreme of the adjustment range and note the reading. Then turn the thumbwheel ZERO control (R101) to the other extreme and note the reading.
   c. Using the insulated screwdriver, adjust R2 (COARSE ZERO) so that the adjustment range of the thumbwheel ZERO gives readings that are equally balanced around 0 mV. (For example, the nominal range of output readings between the two extremes is -9 mV to +9 mV.) This completes the final COARSE ZERO adjustment procedure.



**BALANCE Adjustment**

7. Use the following procedure to make the final GAIN calibration:

   a. Remove the 10-turn coil and connect the 50-turn torroid coil to the amplifier output.

   b. Set the calibrator and amplifier controls to source 3A at 50 or 60 Hz in the 50-turn coil, thus producing 150A turns.

   c. Locate R7 in the probe handle (see Figure 4). Remove the sealing compound if necessary to access the GAIN adjustment.

   d. Clamp the probe around the center of the coil and allow the jaws to close with a snapping action to properly seat the mating surfaces.

   e. Set the voltmeter function and range to accommodate a display of 200 mV ac.

   f. Adjust R7 (GAIN) so that the voltmeter reads 150 mV ±0.1 mV.

   g. Set the amplifier to standby. This completes the final GAIN calibration procedure.

## PERFORMANCE VERIFICATION

### Required Equipment

The equipment required for the performance verification procedure is the first four items listed in Table 2.

### Setup Procedure

Perform the following steps to set up for DC and AC Operation verification procedures:

1. Connect the 50-turn toroid coil to the Transconductance Amplifier output.
2. Connect the DC/AC Voltage Calibrator output to the amplifier input.
3. Turn both instruments on and allow sufficient warm-up time for stable operation.
4. Perform steps 1 through 5 of the BATTERY TEST procedure.

## DC Operation

Use the following procedure to verify the dc operation of the probe:

1. Slide the 80i-1010 power switch to the ON position.
2. With the voltmeter in the DC function, adjust the thumbwheel ZERO control (R101) for a reading of 0.0 ±0.1 mV.
3. Set the calibrator and amplifier controls to source 1A dc in the 50-turn coil, thus producing 50A turns.
4. Clamp the probe around the center of the coil and allow the jaws to close with a snapping action to properly seat the mating surfaces.
5. Set the voltmeter function and range to accommodate a display of 100 mV dc. The voltmeter should display a reading between 48.2 and 51.8 mV.
6. Set the voltmeter range to accommodate a display of 1.000V dc.
7. Set the calibrator and amplifier controls to source 18A dc in the 50-turn coil, thus producing 900A turns. The voltmeter should display a reading between 0.935 and 0.865V dc.
8. Set the amplifier to standby. This completes the DC Operation verification procedure.

## AC Operation

Use the following procedure to verify the ac operation of the probe:

1. Set the voltmeter range to accommodate a reading of 200 mV ac.

2. Set the calibrator and amplifier controls to source 1A at 50 or 60 Hz ac in the 50-turn coil, thus producing 50A turns. The voltmeter should display a reading between 48.2 and 51.8 mV.

3. Set the calibrator and amplifier controls to source 2A at 400 Hz ac in the 50-turn coil, thus producing 100A turns. The voltmeter should display a reading between 97.0 and 103.0 mV ac.

4. Set the voltmeter range to accommodate a display of 1.000V ac.

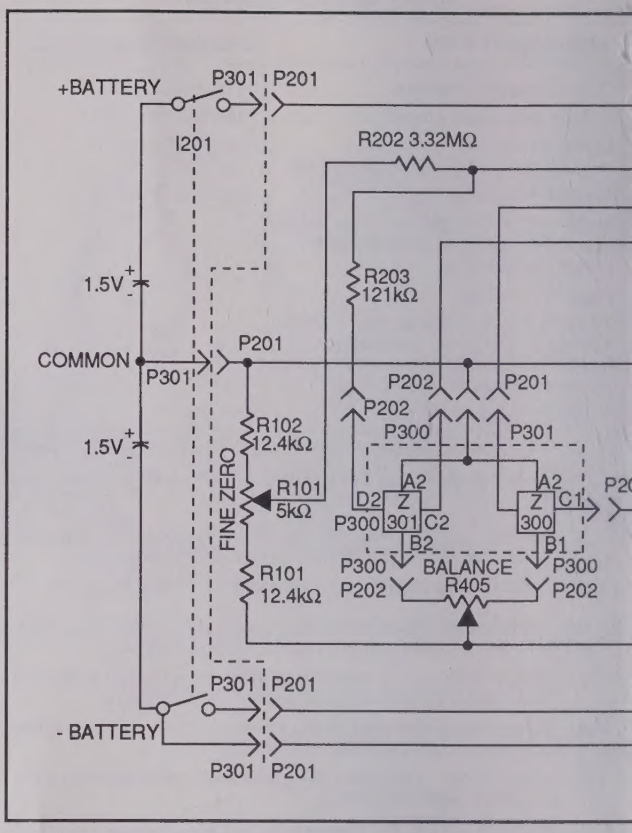
5. Set the calibrator and amplifier controls to source 10A at 50 or 60 Hz ac in the 50-turn coil, thus producing 500A turns. The voltmeter should display a reading between 488.0 and 512.0 mV ac.

6. Set the amplifier to standby.

7. Remove the probe from the 50-turn coil. This completes the AC Operation verification procedure.

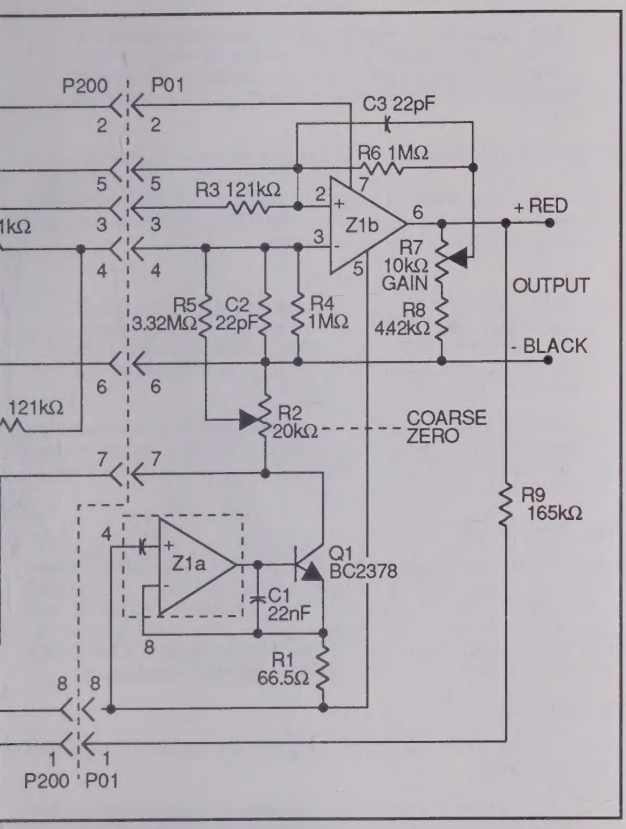
## CLEANING AND STORAGE

Clean the mating surfaces of the core at regular intervals. Apply a light coating of dripless oil to prevent corrosion. If the probe will not be used for periods of longer than 60 days, the batteries should be removed and stored separately.




**Replaceable Parts**

| REFERENCE DESIGNATOR | DESCRIPTION |
|---|---|
| R1 | Resistor, 66.5Ω, 1%, 1/8W, 50 ppm CM |
| R2 | Potentiometer, 20 kΩ 34P |
| R3 | Resistor, 121 kΩ, 1%, 1/8W, 50 ppm CM |
| R4 | Resistor, 1 MΩ, 1%, 1/8W, 50 ppm CM |
| R5 | Resistor, 3.32 MΩ, 1%, 1/8W, 50 ppm CM |
| R6 | Resistor, 1 MΩ, 1%, 1/8W, 50 ppm CM |
| R7 | Potentiometer, 10 kΩ |
| R8 | Resistor, 4.42 kΩ, 1%, 1/8W, 50 ppm CM |
| R9 | Resistor, 165 kΩ, 1%, 1/8W, 50 ppm CM |
| | |
| C1 | Capacitor, 22 nF, 63V, 10%, 1RD 607 |
| C2 | Capacitor, 22 pF, 500V ceramic, BEC 607 |
| C3 | Capacitor, 22 pF, 500V, ceramic, BEC 607 |
| Z1 | Linear amplifier + voltage ref. LM 10 CLN |
| Q1 | Transistor NPN BC 237 B |
| P01 | Male conn. 2x4 pins BERG ref 76345 3037 Z |
| | |
| R100 | Resistor, 12.4 kΩ, 1%, 1/8W, 50 ppm CM |
| R101 | Potentiometer 5 kΩ, 20% V 105-4PVN |
| R102 | Resistor, 12.4 kΩ, 1%, 1/8W, 50 ppm CM |
| R105 | Potentiometer, 100Ω +/-20%, VA 05 H |
| | |
| P200 | Female conn. 2x4 pins BERG ref. 76344 404 |
| P201 | Female connector 5 contacts |
| P202 | Female connector 6 contacts |
| R200 | Resistor, 121 kΩ, 1%, 1/8W, 50 ppm CM |
| R201 | Resistor, 121 kΩ, 1%, 1/8W, 50 ppm CM |
| | |
| P300 | Male connector 6 contacts |
| P301 | Male connector 5 contacts |
| Z300 | Hall effect cell |
| Z301 | Hall effect cell |
| I201-202 | Switch 2 poles, 2 positions SLS 220 |




## WARRANTY

**The JOHN FLUKE MFG. CO., INC. (Fluke) warrants each accessory it manufactures to be free from defects in material and workmanship under normal use and service for a period of 1 year from the date of purchase. This warranty extends only to the original purchaser and shall not apply to batteries or fuses, or to any accessory which has been subjected to misuse, alteration, or abnormal conditions of operation.**

**Fluke's obligation under this warranty is limited to repairing or replacing, at Fluke's option, an accessory returned to an authorized Service Center within 1 year from date of purchase, provided Fluke determines that the accessory fails to conform to this warranty. If the failure has been caused by misuse, alteration, or abnormal conditions of operation, or the warranty period has expired, repair charges will be billed to the purchaser.**

**ANY IMPLIED WARRANTIES OF MERCHANTABILITY SHALL BE LIMITED TO A PERIOD OF TWELVE MONTHS FROM THE DATE OF PURCHASE. THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. FLUKE SHALL NOT BE LIABLE FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, WHETHER IN CONTRACT, TORT OR OTHERWISE.**

**If a failure occurs, forward the accessory, postage prepaid, to a Fluke Service Center with a description of the difficulty. Fluke shall assume NO risk for damage in transit. The repaired accessory will be returned, transportation prepaid.**

**For application or operation assistance or information on Fluke products, call:**

**800-443-5853 or 800-44-FLUKE in U.S.A. and Canada**
**206-356-5500 from other countries**

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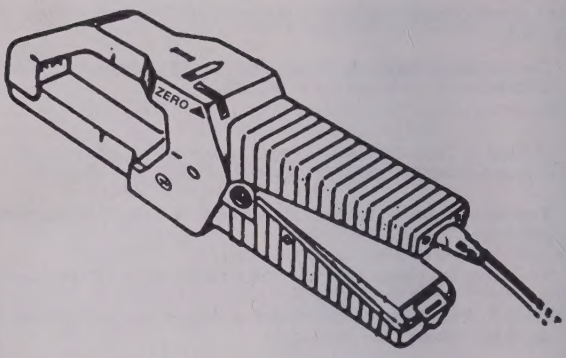


## INTRODUCTION

The Fluke 80i-1010 DC/AC Current Probe is a battery-powered clamp-on current probe that is used with a voltmeter or digital multimeter to measure dc currents up to 1000 amps or ac currents up to 700 amps. Each jaw of the probe contains half of a magnetic core. The jaws clamp around a conductor allowing current measurements without breaking the circuit. Dual Hall sensors mounted in gaps of the core sense the magnetic field produced by the current being measured. An amplifier circuit generates an output signal of 1 mV per amp. A convenient thumbwheel ZERO control provides a method to offset core magnetization, thereby improving accuracy of dc current measurements down to 1 amp.

## SPECIFICATIONS

### ELECTRICAL:

**Current Range:** 1 to 1000A dc
1 to 700A ac

**Frequency Range:** dc to 440 H

**Output Signal:** 1 mV per amp dc or ac

**Accuracy* (uncertainty):** ±% of reading, 1 year

| | | |
|---|---|---|
| dc | 1 to 100A: | 2% +1A |
| | 100 to 700A: | 3% |
| | 700 to 1000A: | 5% |
| ac (48 to 62 Hz) | | |
| | 1 to 100A: | 2% + 1A |
| | 100 to 700A: | 3% |
| ac (62 to 440 Hz) | | |
| | 1 to 100A: | 3% + 1A |
| | 100 to 700A: | 5% |

* 18 to 28°C (64 to 82°F), conductor centered, ZERO adjustment prior to measurement (dc only).

**Frequency Response:** -3 dB at 6 kHz typical

**Working Voltage:** 660V rms maximum at input

**Maximum Conductor Sizes:** 1 ea 750 MCM (30 mm (1.18") diameter) or 2 ea 500 MCM (25 mm (0.98") diameter) or 2.5" x 0.2" Bus Bar (63 mm x 5 mm)

**Load Impedance:** >1 MΩ, 100 pF (The probe's output circuit can drive impedances as low as 1 kΩ (chart recorders etc.). However, the battery test indication will be incorrect (low) if the meter input impedance is less than 1 MΩ.)

### GENERAL

**Temperature Coefficient:** ±0.06 X specification per °C (0 to 18°C, 28 to 50°C)

**Operating Temperature:** 0 to 50°C (32 to 122°F)

**Storage Temperature:** -40 to 60°C (-40 to 140°F)

**Relative Humidity:** 0 to 90% (0 to 35°C)
0 to 70% (35 to 50°C)

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